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ES4016  
ES4024  
Gigabit Ethernet Switch

Installation Guide  
**Installationsanleitung**

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## Installation Guide

# Gigabit Ethernet Switch

*Layer 2 Workgroup Switch*

*with 16/24 10/100/1000BASE-T (RJ-45) Ports*

ES4016  
ES4024  
E032007-MT-R01  
150000025900H

# Compliances and Safety Warnings

## FCC - Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

You are cautioned that changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

You may use unshielded twisted-pair (UTP) for RJ-45 connections - Category 3 or better for 10 Mbps connections, Category 5 or better for 100 Mbps connections, Category 5, 5e, or 6 for 1000 Mbps connections. For fiber optic connections, you may use 50/125 or 62.5/125 micron multimode fiber or 9/125 micron single-mode fiber.

## Industry Canada - Class A

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus as set out in the interference-causing equipment standard entitled "Digital Apparatus," ICES-003 of the Department of Communications.

Cet appareil numérique respecte les limites de bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Appareils Numériques," NMB-003 édictée par le ministère des Communications.

## Japan VCCI Class A

この装置は、情報処理装置等電波障害自主規制協議会（VCCI）の基準に基づくクラスA情報技術装置です。この装置を家庭環境で使用すると電波妨害を引き起こすことがあります。この場合には使用者が適切な対策を講ずるよう要求されることがあります。

## CE Mark Declaration of Conformance for EMI and Safety (EEC)

This information technology equipment complies with the requirements of the Council Directive 89/336/EEC on the Approximation of the laws of the Member States relating to Electromagnetic Compatibility and 73/23/EEC for electrical equipment used within certain voltage limits and the Amendment Directive 93/68/EEC. For the evaluation of the compliance with these Directives, the following standards were applied:

- RFI Emission:
- Limit class A according to EN 55022:1998
  - Limit class A for harmonic current emission according to EN 61000-3-2:1995
  - Limitation of voltage fluctuation and flicker in low-voltage supply system according to EN 61000-3-3:1995
- Immunity:
- Product family standard according to EN 55024:1998
  - Electrostatic Discharge according to EN 61000-4-2:1995 (Contact Discharge:  $\pm 4$  kV, Air Discharge:  $\pm 8$  kV)
  - Radio-frequency electromagnetic field according to EN 61000-4-3:1996 (80 - 1000 MHz with 1 kHz AM 80% Modulation: 3 V/m)
  - Electrical fast transient/burst according to EN 61000-4-4:1995 (AC/DC power supply:  $\pm 1$  kV, Data/Signal lines:  $\pm 0.5$  kV)
  - Surge immunity test according to EN 61000-4-5:1995 (AC/DC Line to Line:  $\pm 1$  kV, AC/DC Line to Earth:  $\pm 2$  kV)
  - Immunity to conducted disturbances, Induced by radio-frequency fields: EN 61000-4-6:1996 (0.15 - 80 MHz with 1 kHz AM 80% Modulation: 3 V/m)
  - Power frequency magnetic field immunity test according to EN 61000-4-8:1993 (1 A/m at frequency 50 Hz)
  - Voltage dips, short interruptions and voltage variations immunity test according to EN 61000-4-11:1994 (>95% Reduction @10 ms, 30% Reduction @500 ms, >95% Reduction @5000 ms)
- LVD:
- EN 60950-1:2001

**Caution:** Do not plug a phone jack connector in the RJ-45 port. This may damage this device.

**Attention:** Les raccordeurs ne sont pas utilisés pour le système téléphonique!

## Australia AS/NZS 3548 (1995) - Class A



ACN 066 352 010

## Please read the following safety information carefully before installing the switch:

**WARNING:** Installation and removal of the unit must be carried out by qualified personnel only.

- The unit must be connected to an earthed (grounded) outlet to comply with international safety standards.
- Do not connect the unit to an A.C. outlet (power supply) without an earth (ground) connection.
- The appliance coupler (the connector to the unit and not the wall plug) must have a configuration for mating with an EN 60320/IEC 320 appliance inlet.
- The socket outlet must be near to the unit and easily accessible. You can only remove power from the unit by disconnecting the power cord from the outlet.
- This unit operates under SELV (Safety Extra Low Voltage) conditions according to IEC 60950. The conditions are only maintained if the equipment to which it is connected also operates under SELV conditions.

### *France and Peru only*

This unit cannot be powered from IT<sup>†</sup> supplies. If your supplies are of IT type, this unit must be powered by 230 V (2P+T) via an isolation transformer ratio 1:1, with the secondary connection point labelled Neutral, connected directly to earth (ground).

† Impédance à la terre

Power Cord Set	
U.S.A. and Canada	The cord set must be UL-approved and CSA certified.
	The minimum specifications for the flexible cord are: - No. 18 AWG - not longer than 2 meters, or 16 AWG. - Type SV or SJ - 3-conductor
	The cord set must have a rated current capacity of at least 10 A
	The attachment plug must be an earth-grounding type with NEMA 5-15P (15 A, 125 V) or NEMA 6-15P (15 A, 250 V) configuration.
Denmark	The supply plug must comply with Section 107-2-D1, Standard DK2-1a or DK2-5a.
Switzerland	The supply plug must comply with SEV/ASE 1011.
U.K.	The supply plug must comply with BS1363 (3-pin 13 A) and be fitted with a 5 A fuse which complies with BS1362.
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
Europe	The supply plug must comply with CEE7/7 ("SCHUKO").
	The mains cord must be <HAR> or <BASEC> marked and be of type HO3VVF3GO.75 (minimum).
	IEC-320 socket.

## **Veillez lire à fond l'information de la sécurité suivante avant d'installer le Switch:**

**AVERTISSEMENT:** L'installation et la dépose de ce groupe doivent être confiés à un personnel qualifié.

- Ne branchez pas votre appareil sur une prise secteur (alimentation électrique) lorsqu'il n'y a pas de connexion de mise à la terre (mise à la masse).
- Vous devez raccorder ce groupe à une sortie mise à la terre (mise à la masse) afin de respecter les normes internationales de sécurité.
- Le coupleur d'appareil (le connecteur du groupe et non pas la prise murale) doit respecter une configuration qui permet un branchement sur une entrée d'appareil EN 60320/IEC 320.
- La prise secteur doit se trouver à proximité de l'appareil et son accès doit être facile. Vous ne pouvez mettre l'appareil hors circuit qu'en débranchant son cordon électrique au niveau de cette prise.
- L'appareil fonctionne à une tension extrêmement basse de sécurité qui est conforme à la norme IEC 60950. Ces conditions ne sont maintenues que si l'équipement auquel il est raccordé fonctionne dans les mêmes conditions.

### *France et Pérou uniquement:*

Ce groupe ne peut pas être alimenté par un dispositif à impédance à la terre. Si vos alimentations sont du type impédance à la terre, ce groupe doit être alimenté par une tension de 230 V (2 P+T) par le biais d'un transformateur d'isolement à rapport 1:1, avec un point secondaire de connexion portant l'appellation Neutre et avec raccordement direct à la terre (masse).

<b>Cordon électrique - Il doit être agréé dans le pays d'utilisation</b>	
Etats-Unis et Canada:	Le cordon doit avoir reçu l'homologation des UL et un certificat de la CSA.
	Les spécifications minimales pour un câble flexible sont AWG No. 18, ou AWG No. 16 pour un câble de longueur inférieure à 2 mètres. - type SV ou SJ - 3 conducteurs
	Le cordon doit être en mesure d'acheminer un courant nominal d'au moins 10 A.
	La prise femelle de branchement doit être du type à mise à la terre (mise à la masse) et respecter la configuration NEMA 5-15P (15 A, 125 V) ou NEMA 6-15P (15 A, 250 V).
Danemark:	La prise mâle d'alimentation doit respecter la section 107-2 D1 de la norme DK2 1a ou DK2 5a.
Suisse:	La prise mâle d'alimentation doit respecter la norme SEV/ASE 1011.
Europe	La prise secteur doit être conforme aux normes CEE 7/7 ("SCHUKO") Le cordon secteur doit porter la mention <HAR> ou <BASEC> et doit être de type HO3VVF3GO.75 (minimum).



## Bitte unbedingt vor dem Einbauen des Switches die folgenden Sicherheitsanweisungen durchlesen:

**WARNING:** Die Installation und der Ausbau des Geräts darf nur durch Fachpersonal erfolgen.

- Das Gerät sollte nicht an eine ungeerdete Wechselstromsteckdose angeschlossen werden.
- Das Gerät muß an eine geerdete Steckdose angeschlossen werden, welche die internationalen Sicherheitsnormen erfüllt.
- Der Gerätestecker (der Anschluß an das Gerät, nicht der Wandsteckdosenstecker) muß einen gemäß EN 60320/IEC 320 konfigurierten Geräteeingang haben.
- Die Netzsteckdose muß in der Nähe des Geräts und leicht zugänglich sein. Die Stromversorgung des Geräts kann nur durch Herausziehen des Gerätenetzkabels aus der Netzsteckdose unterbrochen werden.
- Der Betrieb dieses Geräts erfolgt unter den SELV-Bedingungen (Sicherheitskleinstspannung) gemäß IEC 60950. Diese Bedingungen sind nur gegeben, wenn auch die an das Gerät angeschlossenen Geräte unter SELV-Bedingungen betrieben werden.

<b>Stromkabel.</b> Dies muss von dem Land, in dem es benutzt wird geprüft werden:	
Schweiz	Dieser Stromstecker muß die SEV/ASE 1011Bestimmungen einhalten.
Europe	Das Netzkabel muß vom Typ HO3VVF3GO.75 (Mindestanforderung) sein und die Aufschrift <HAR> oder <BASEC> tragen. Der Netzstecker muß die Norm CEE 7/7 erfüllen ("SCHUKO").

## Warnings and Cautionary Messages

**Warning:** This product does not contain any serviceable user parts.

**Warning:** Installation and removal of the unit must be carried out by qualified personnel only.

**Warning:** When connecting this device to a power outlet, connect the field ground lead on the tri-pole power plug to a valid earth ground line to prevent electrical hazards.

**Caution:** Do not plug a phone jack connector in the RJ-45 port. This may damage this device. Les raccordeurs ne sont pas utilisé pour le système téléphonique!

**Caution:** Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

**Caution:** Wear an anti-static wrist strap or take other suitable measures to prevent electrostatic discharge when handling this equipment.

## Warnings (In German)

- Achtung:** Dieses Produkt enthält keine Teile, die eine Wartung vom Benutzer benötigen.
- Achtung:** Wenn das Gerät an eine Steckdose angeschlossen wird, muß der Masseanschluß am dreipoligen Netzstecker mit Schutzterde verbunden werden, um elektrische Gefahren zu vermeiden.

## Environmental Statement

The manufacturer of this product endeavours to sustain an environmentally-friendly policy throughout the entire production process. This is achieved through the following means:

- Adherence to national legislation and regulations on environmental production standards.
- Conservation of operational resources.
- Waste reduction and safe disposal of all harmful un-recyclable by-products.
- Recycling of all reusable waste content.
- Design of products to maximize recyclables at the end of the product's life span.
- Continual monitoring of safety standards.

### End of Product Life Span

This product is manufactured in such a way as to allow for the recovery and disposal of all included electrical components once the product has reached the end of its life.

### Manufacturing Materials

There are no hazardous nor ozone-depleting materials in this product.

### Documentation

All printed documentation for this product uses biodegradable paper that originates from sustained and managed forests. The inks used in the printing process are non-toxic.

## Purpose

This guide details the hardware features of the switch, including the physical and performance-related characteristics, and how to install the switch.

## Audience

The guide is intended for use by network administrators who are responsible for installing and setting up network equipment; consequently, it assumes a basic working knowledge of LANs (Local Area Networks).

Diese Anleitung ist für die Benutzung durch Netzwerkadministratoren vorgesehen, die für die Installation und das Einstellen von Netzwerkkomponenten verantwortlich sind; sie setzt Erfahrung bei der Arbeit mit LANs (Local Area Networks) voraus.

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# Chapter 1: Introduction

## Overview

These switches are high-performance Gigabit Ethernet switches designed for delivering Gigabit connectivity to the desktop. They provide 16/24 full-duplex 1000BASE-T ports that significantly improve network performance and boost throughput for high-bandwidth applications. With 32/48 Gigabits of aggregate bandwidth, these switches provide the quickest solution to meeting the growing demands on your network's limited resources.

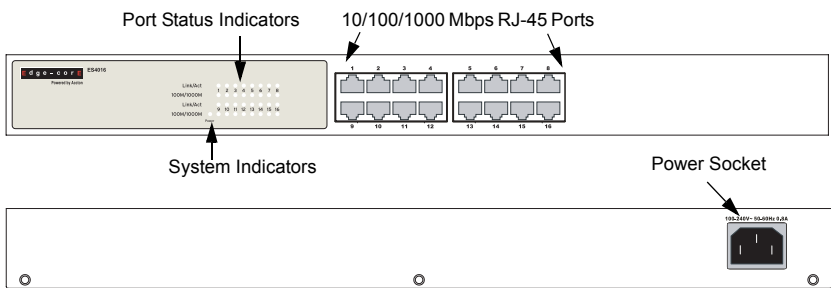


Figure 1-1. ES4016 Front and Rear Panels

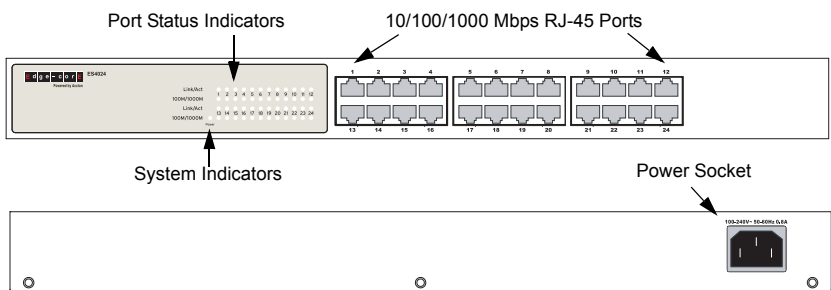


Figure 1-2. ES4024 Front and Rear Panels

## Switch Architecture

These switches employ a wire-speed, non-blocking switching fabric. This permits simultaneous wire-speed transport of multiple packets at low latency on all ports. These switches also features full-duplex capability on all ports, which effectively doubles the bandwidth of each connection.

These switches use store-and-forward switching to ensure maximum data integrity. With store-and-forward switching, the entire packet must be received into a buffer and checked for validity before being forwarded. This prevents errors from being propagated throughout the network.

## Description of Hardware

### 10/100/1000BASE-T Ports

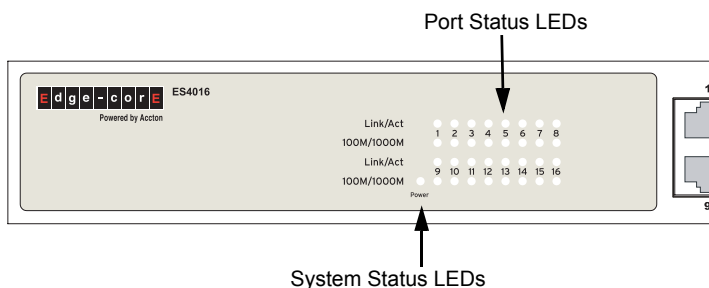
These switches contain 16/24 RJ-45 ports that operate at 10 Mbps or 100 Mbps, half or full duplex, or 1000 Mbps, full duplex. Because all ports on both switches support automatic MDI/MDI-X operation, you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. (See “10BASE-T/100BASE-TX Pin Assignments” on page B-1.)

Each of these ports support auto-negotiation, so the optimum transmission mode (half or full duplex), and data rate (10, 100, or 1000 Mbps) can be selected automatically.

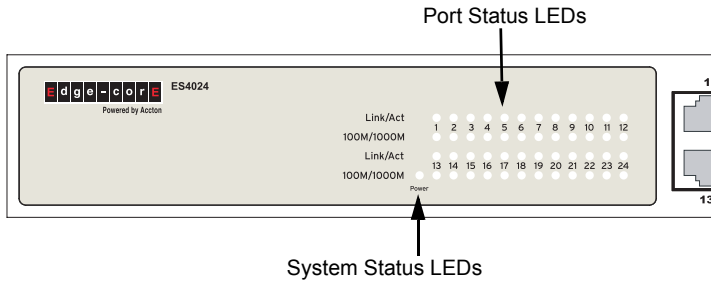
Each port also supports auto-negotiation of flow control, so the switch can automatically prevent port buffers from becoming saturated.

### Port and System Status LEDs

The LEDs, which are located on the front panel for easy viewing, are shown below and described in the following table.



**Figure 1-3. ES4016 Port and System Status LEDs**



**Figure 1-4. ES4024 Port and System Status LEDs**

Table 1-1 ES4016 / ES4024 Port Status LEDs		
LED	Condition	Status
RJ-45 Ports		
Link/ACT (Link/Activity)	On/Flashing Green	The port has established a valid network connection. Flashing indicates activity.
	Off	There is no valid link on the port.
100M/1000M	On Green	The port has a valid 1000 Mbps link.
	On Yellow	The port has a valid 100 Mbps link.
	Off	When the Link LED is on, indicates the port has a valid 10 Mbps link.

Table 1-2 ES4016 / ES4024 System Status LEDs		
LED	Condition	Status
PWR (Power)	On Green	Internal power is operating normally.
	Off	Power off or failure.

## Power Supply Socket

There is one standard power socket on the rear panel of each switch for the AC power cord.



**Figure 1-5. ES4016/ES4024 Power Supply Socket**

## Features and Benefits

### Connectivity

- 16/24 10/100/1000BASE-T RJ-45 ports.
- Auto-negotiation enables each RJ-45 port to automatically select the optimum speed (10, 100, or 1000 Mbps), and the communication mode (half or full duplex) if this feature is supported by the attached device.
- Independent RJ-45 10/100/1000BASE-T ports with auto MDI/MDI-X pinout selection.
- Unshielded (UTP) cable supported on all RJ-45 ports: Category 3, 4 or 5 for 10 Mbps connections, Category 5 for 100 Mbps connections, and Category 5 or better for 1000 Mbps connections.
- IEEE 802.3-2005 Ethernet, Fast Ethernet, Gigabit Ethernet compliance ensures compatibility with standards-based hubs, network cards and switches from any vendor.
- “At-a-glance” LEDs for port and system status monitoring.
- Desktop installation.

### Performance

- Transparent bridging
- Switching table with a total of 8K MAC address entries
- Provides store-and-forward switching
- Support for 9 KB jumbo frames
- Supports wire-speed filtering and forwarding
- Supports flow control, using back pressure for half duplex and IEEE 802.3x for full duplex
- Broadcast storm control

## Chapter 2: Network Planning

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### Introduction to Switching

A network switch allows simultaneous transmission of multiple packets via non-crossbar switching. This means that it can partition a network more efficiently than bridges or routers. The switch has, therefore, been recognized as one of the most important building blocks for today's networking technology.

When performance bottlenecks are caused by congestion at the network access point (such as the network card for a high-volume file server), the device experiencing congestion (server, power user, or hub) can be attached directly to a switched port. And, by using full-duplex mode, the bandwidth of the dedicated segment can be doubled to maximize throughput.

When networks are based on repeater (hub) technology, the distance between end stations is limited by a maximum hop count. However, a switch turns the hop count back to zero. So subdividing the network into smaller and more manageable segments, and linking them to the larger network by means of a switch, removes this limitation.

A switch can be easily configured in any Ethernet, Fast Ethernet, or Gigabit Ethernet network to significantly boost bandwidth while using conventional cabling and network cards.

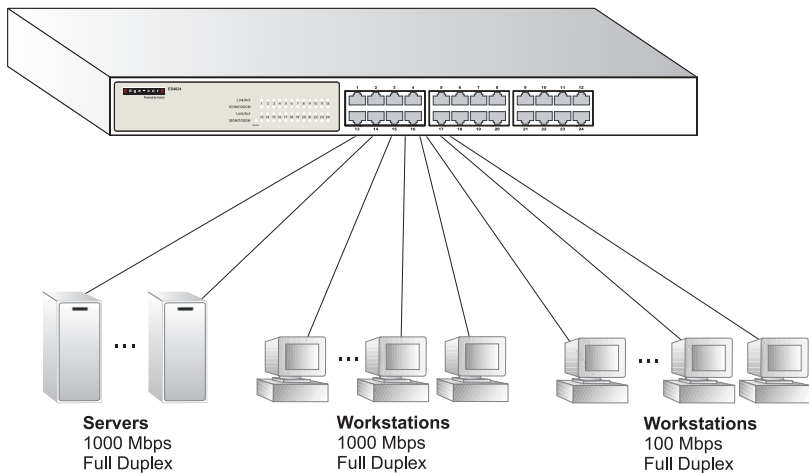
# Application Examples

These switches are not only designed to segment your network, but also to provide a wide range of options in setting up network connections. Some typical applications are described in the following pages.

## Collapsed Backbone

These switches are an excellent choice for mixed Ethernet, Fast Ethernet, and Gigabit Ethernet installations where significant growth is expected in the near future. In a basic stand-alone configuration, it can provide direct full-duplex connections to workstations or servers. When the time comes for further expansion, just connect to another hub or switch using one of the Gigabit Ethernet ports built into the front panel.

In the figure below, the switch is operating as a collapsed backbone for a small LAN. It is providing dedicated 100 Mbps full-duplex connections to workstations and 1000 Mbps full-duplex connections to power users and servers.

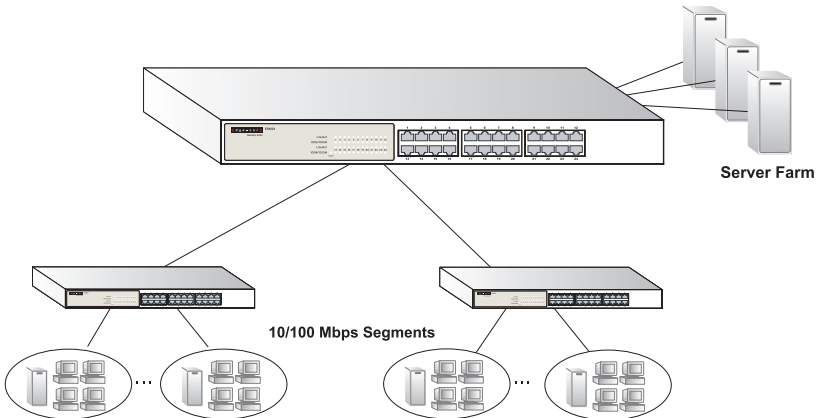


**Figure 2-1. Collapsed Backbone**

## Network Aggregation Plan

With 16 or 24 parallel bridging ports (i.e., 16 or 24 distinct collision domains), the switch can collapse a small network down into a single efficient bridged node, increasing overall bandwidth and throughput.

In the figure below, the ports on the switch are providing 100 Mbps connectivity through layer 2 switches. In addition, the switch is also connecting several servers at 1000 Mbps.



**Figure 2-2. Network Aggregation Plan**

## Application Note

Full-duplex operation only applies to point-to-point access (such as when a switch is attached to a workstation, server or another switch). When the switch is connected to a hub, both devices must operate in half-duplex mode.



# Chapter 3: Installing the Switch

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## Selecting a Site

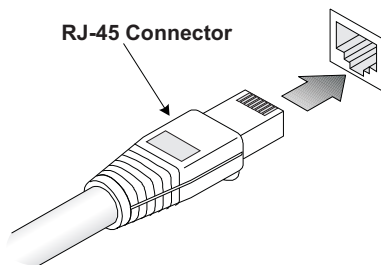
Switch units can be mounted in a standard 19-inch equipment rack or on a flat surface. Be sure to follow the guidelines below when choosing a location.

- The site should:
  - be at the center of all the devices you want to link and near a power outlet.
  - be able to maintain its temperature within 0 to 40 °C (32 to 104 °F) and its humidity within 10% to 90%, non-condensing
  - provide adequate space (approximately two inches) on all sides for proper air flow
  - be accessible for installing, cabling and maintaining the devices
  - allow the status LEDs to be clearly visible
- Make sure twisted-pair cable is always routed away from power lines, fluorescent lighting fixtures and other sources of electrical interference, such as radios and transmitters.
- Make sure that a separate grounded power outlet that provides 100 to 240 VAC, 50 to 60 Hz, is within 2.44 m (8 feet) of each device and is powered from an independent circuit breaker. As with any equipment, using a filter or surge suppressor is recommended.

## Ethernet Cabling

To ensure proper operation when installing the switch into a network, make sure that the current cables are suitable for 10BASE-T, 100BASE-TX or 1000BASE-T operation. Check the following criteria against the current installation of your network:

- Cable type: Unshielded twisted pair (UTP) or shielded twisted pair (STP) cables with RJ-45 connectors; Category 3 or better for 10BASE-T, Category 5 or better for 100BASE-TX, and Category 5, 5e, or 6 for 1000BASE-T.
- Protection from radio frequency interference emissions
- Electrical surge suppression
- Separation of electrical wires (switch related or other) and electromagnetic fields from data based network wiring
- Safe connections with no damaged cables, connectors or shields



**Figure 3-1. RJ-45 Connections**

## Equipment Checklist

After unpacking the switch, check the contents to be sure you have received all the components. Then, before beginning the installation, be sure you have all other necessary installation equipment.

### Package Contents

- ES4016 or ES4024 Gigabit Ethernet Switch
- Four adhesive foot pads
- Bracket Mounting Kit containing two brackets and eight screws for attaching the brackets to the switch
- AC Power Cord
- This Installation Guide

### Optional Rack-Mounting Equipment

If you plan to rack-mount the switch, be sure to have the following equipment available:

- Four mounting screws for each device you plan to install in a rack—these are not included
- A screwdriver (Phillips or flathead, depending on the type of screws used)

## Mounting

The switch units can be mounted in a standard 19-inch equipment rack or on a desktop or shelf. Mounting instructions for each type of site follow.

### Rack Mounting

Before rack mounting the switch, pay particular attention to the following factors:

- **Temperature:** Since the temperature within a rack assembly may be higher than the ambient room temperature, check that the rack-environment temperature is within the specified operating temperature range. (See page C-2.)
- **Mechanical Loading:** Do not place any equipment on top of a rack-mounted unit.
- **Circuit Overloading:** Be sure that the supply circuit to the rack assembly is not overloaded.
- **Grounding:** Rack-mounted equipment should be properly grounded. Particular attention should be given to supply connections other than direct connections to the mains.

#### To rack-mount devices:

1. Attach the brackets to the device using the screws provided in the Bracket Mounting Kit.

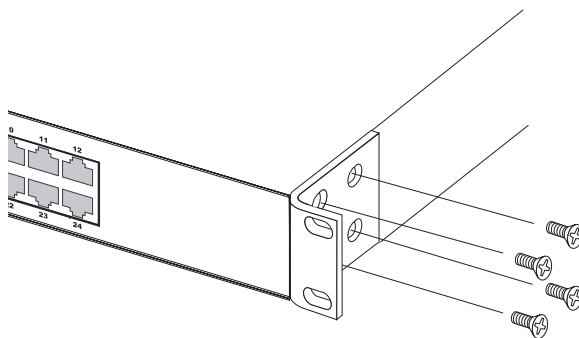
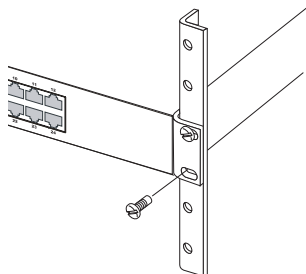


Figure 3-2. Attaching the Brackets

### **3** Installing the Switch

2. Mount the device in the rack, using four rack-mounting screws (not provided).

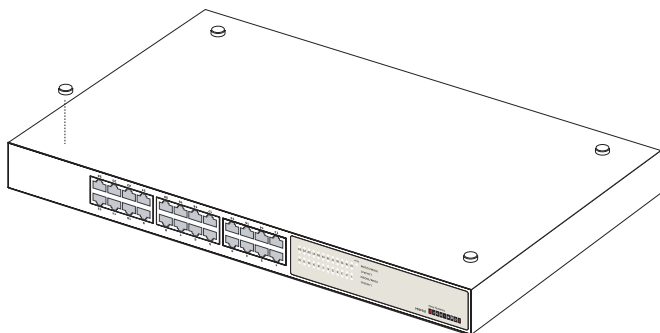


**Figure 3-3. Installing the Switch in a Rack**

3. If installing a single switch only, turn to “Connecting to a Power Source” at the end of this chapter.
4. If installing multiple switches, mount them in the rack, one below the other, in any order.

### **Desktop or Shelf Mounting**

1. Attach the four adhesive feet to the bottom of the first switch.



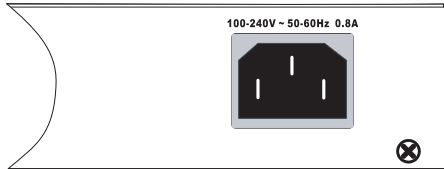
**Figure 3-4. Attaching the Adhesive Feet**

2. Set the device on a flat surface near an AC power source, making sure there are at least two inches of space on all sides for proper air flow.
3. If installing a single switch only, go to “Connecting to a Power Source” at the end of this chapter.
4. If installing multiple switches, attach four adhesive feet to each one. Place each device squarely on top of the one below, in any order.

## Connecting to a Power Source

To connect a device to a power source:

1. Insert the power cable plug directly into the socket located at the back of the device.



**Figure 3-5. Power Socket**

2. Plug the other end of the cable into a grounded, 3-pin socket.

**Note:** For International use, you may need to change the AC line cord. You must use a line cord set that has been approved for the socket type in your country.

3. Check the front-panel LEDs as the device is powered on to be sure the Power LED is lit. If not, check that the power cable is correctly plugged in.

# 3

## Installing the Switch

# Chapter 4: Making Network Connections

---

## Connecting Network Devices

These switches are designed to interconnect multiple segments (or collision domains). It can be connected to network cards in PCs and servers, as well as to hubs, switches or routers.

## Twisted-Pair Devices

Each device requires an unshielded twisted-pair (UTP) cable with RJ-45 connectors at both ends. Use Category 5, 5e or 6 cable for 1000BASE-T connections, Category 5 or better for 100BASE-TX connections, and Category 3 or better for 10BASE-T connections.

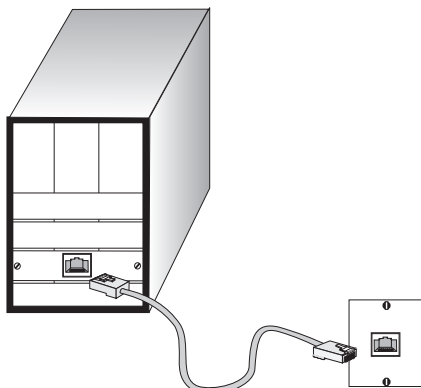
## Cabling Guidelines

The RJ-45 ports on the switch supports automatic MDI/MDI-X pinout configuration, so you can use standard straight-through twisted-pair cables to connect to any other network device (PCs, servers, switches, routers, or hubs).

**Caution:** Do not plug a phone jack connector into an RJ-45 port. This will damage the switch. Use only twisted-pair cables with RJ-45 connectors that conform to FCC standards.

## Connecting to PCs, Servers, Hubs and Switches

1. Attach one end of a twisted-pair cable segment to the device's RJ-45 connector.



**Figure 4-1. Making Twisted-Pair Connections**

## 4 Making Network Connections

2. If the device is a PC card and the switch is in the wiring closet, attach the other end of the cable segment to a modular wall outlet that is connected to the wiring closet. Otherwise, attach the other end to an available port on the switch.

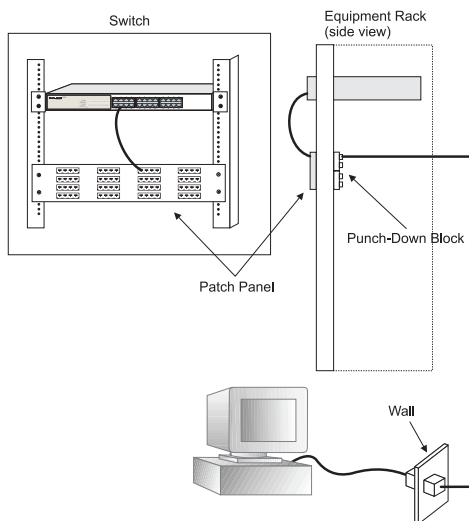
Make sure each twisted pair cable does not exceed 100 meters (328 ft) in length.

3. As each connection is made, the Link LED (on the switch) corresponding to each port will light to indicate that the connection is valid.

### Network Wiring Connections

Today, the punch-down block is an integral part of many of the newer equipment racks. It is actually part of the patch panel. Instructions for making connections in the wiring closet with this type of equipment follows.

1. Attach one end of a patch cable to an available port on the switch, and the other end to the patch panel.
2. If not already in place, attach one end of a cable segment to the back of the patch panel where the punch-down block is located, and the other end to a modular wall outlet.
3. Label the cables to simplify future troubleshooting.



**Figure 4-2. Network Wiring Connections**



## Connectivity Rules

When adding hubs (repeaters) to your network, please follow the connectivity rules listed in the manuals for these products. However, note that because switches break up the path for connected devices into separate collision domains, you should not include the switch or connected cabling in your calculations for cascade length involving other devices.

### 1000BASE-T Cable Requirements

All Category 5 UTP cables that are used for 100BASE-TX connections should also work for 1000BASE-T, providing that all four wire pairs are connected. However, it is recommended that for all critical connections, or any new cable installations, Category 5e (enhanced Category 5) or Category 6 cable should be used. The Category 5e specification includes test parameters that are only recommendations for Category 5. Therefore, the first step in preparing existing Category 5 cabling for running 1000BASE-T is a simple test of the cable installation to be sure that it complies with the IEEE 802.3-2005 standards.

### 1000 Mbps Gigabit Ethernet Collision Domain

Table 4-1. Maximum Gigabit Ethernet Cable Length			
Type	Cable Type	Max. Cable Length	Connector
1000BASE-T	Category 5, 5e, 6 100-ohm UTP or STP	100 m (328 ft)	RJ-45

### 100 Mbps Fast Ethernet Collision Domain

Table 4-2. Maximum Fast Ethernet Cable Length			
Type	Cable Type	Max. Cable Length	Connector
100BASE-TX	Category 5 or better 100-ohm UTP or STP	100 m (328 ft)	RJ-45

### 10 Mbps Ethernet Collision Domain

Table 4-3. Maximum Ethernet Cable Length			
Type	Cable Type	Max. Cable Length	Connector
10BASE-T	Twisted Pair, Categories 3, 4, 5 or better 100-ohm UTP	100 m (328 ft)	RJ-45

## Cable Labeling and Connection Records

When planning a network installation, it is essential to label the opposing ends of cables and to record where each cable is connected. Doing so will enable you to easily locate inter-connected devices, isolate faults and change your topology without need for unnecessary time consumption.

To best manage the physical implementations of your network, follow these guidelines:

- Clearly label the opposing ends of each cable.
- Using your building's floor plans, draw a map of the location of all network-connected equipment. For each piece of equipment, identify the devices to which it is connected.
- Note the length of each cable and the maximum cable length supported by the switch ports.
- For ease of understanding, use a location-based key when assigning prefixes to your cable labeling.
- Use sequential numbers for cables that originate from the same equipment.
- Differentiate between racks by naming accordingly.
- Label each separate piece of equipment.
- Display a copy of your equipment map, including keys to all abbreviations at each equipment rack.

# Appendix A: Troubleshooting

---

## Diagnosing Switch Indicators

Table A-1. Troubleshooting Chart	
Symptom	Action
Power LED is Off	<ul style="list-style-type: none"><li>• Power supply is disconnected.</li><li>• Check connections between the switch, the power cord, and the wall outlet.</li><li>• Contact your dealer for assistance.</li></ul>
Link LED is Off	<ul style="list-style-type: none"><li>• Verify that the switch and attached device are powered on.</li><li>• Be sure the cable is plugged into both the switch and corresponding device.</li><li>• Verify that the proper cable type is used and its length does not exceed specified limits.</li><li>• Check the adapter on the attached device and cable connections for possible defects. Replace the defective adapter or cable if necessary.</li></ul>

## Power and Cooling Problems

If the power indicator does not turn on when the power cord is plugged in, you may have a problem with the power outlet, power cord, or internal power supply. However, if the unit powers off after running for a while, check for loose power connections, power losses or surges at the power outlet, and verify that the fans on the unit are unobstructed and running prior to shutdown. If you still cannot isolate the problem, then the internal power supply may be defective.

**Note:** Cooling fans are only available in the ES4024 switch.

## Installation

Verify that all system components have been properly installed. If one or more components appear to be malfunctioning (such as the power cord or network cabling), test them in an alternate environment where you are sure that all the other components are functioning properly.



## Appendix B: Cables

---

### Twisted-Pair Cable and Pin Assignments

For 10/100BASE-TX connections, a twisted-pair cable must have two pairs of wires. For 1000BASE-T connections the twisted-pair cable must have four pairs of wires. Each wire pair is identified by two different colors. For example, one wire might be green and the other, green with white stripes. Also, an RJ-45 connector must be attached to both ends of the cable.

**Caution:** Each wire pair must be attached to the RJ-45 connectors in a specific orientation.

**Caution:** DO NOT plug a phone jack connector into any RJ-45 port. This will damage the switch. Use only twisted-pair cables with RJ-45 connectors that conform with FCC standards.

The figure below illustrates how the pins on the RJ-45 connector are numbered. Be sure to hold the connectors in the same orientation when attaching the wires to the pins.

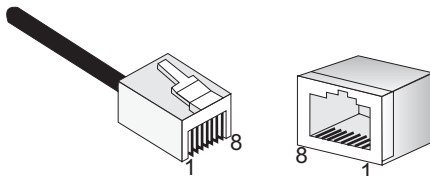


Figure B-1. RJ-45 Connector Pin Numbers

### 10BASE-T/100BASE-TX Pin Assignments

Use unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for RJ-45 connections: 100-ohm Category 3 or better cable for 10 Mbps connections, or 100-ohm Category 5 or better cable for 100 Mbps connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

The RJ-45 ports on the switch base unit support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs. In straight-through cable, pins 1, 2, 3, and 6, at one end of the cable, are connected straight through to pins 1, 2, 3, and 6 at the other end of the cable. When using any RJ-45 port on this switch, you can use either straight-through or crossover cable.

Table B-1. 10/100BASE-TX MDI and MDI-X Port Pinouts		
Pin	MDI Signal Name	MDI-X Signal Name
1	Transmit Data plus (TD+)	Receive Data plus (RD+)
2	Transmit Data minus (TD-)	Receive Data minus (RD-)
3	Receive Data plus (RD+)	Transmit Data plus (TD+)
6	Receive Data minus (RD-)	Transmit Data minus (TD-)
4,5,7,8	Not used	Not used

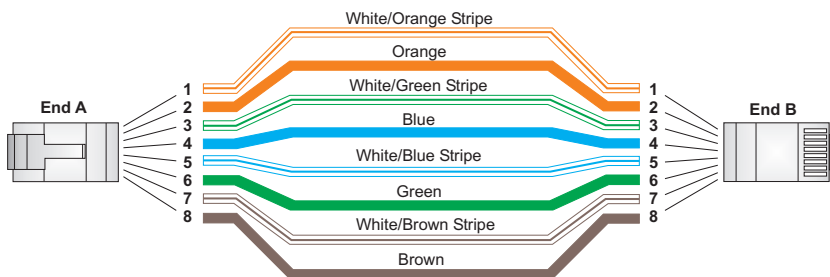
**Note:** The "+" and "-" signs represent the polarity of the wires that make up each wire pair.

## Straight-Through Wiring

If the twisted-pair cable is to join two ports and only one of the ports has an internal crossover (MDI-X), the two pairs of wires must be straight-through. (Auto-negotiation is always enabled for all ports on these switches, you can use either straight-through or crossover cable to connect to any device type.)

You must connect all four wire pairs as shown in the following diagram to support Gigabit Ethernet connections.

EIA/TIA 568B RJ-45 Wiring Standard  
10/100BASE-TX Straight-through Cable

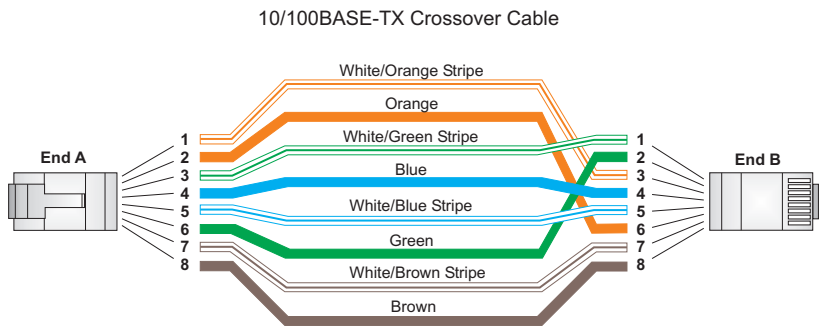


**Figure B-2. Straight-through Wiring**

## Crossover Wiring

If the twisted-pair cable is to join two ports and either both ports are labeled with an "X" (MDI-X) or neither port is labeled with an "X" (MDI), a crossover must be implemented in the wiring. (Auto-negotiation is always enabled for all ports on these switches, you can use either straight-through or crossover cable to connect to any device type.)

You must connect all four wire pairs as shown in the following diagram to support Gigabit Ethernet connections.



### 1000BASE-T Pin Assignments

All 1000BASE-T ports support automatic MDI/MDI-X operation, so you can use straight-through cables for all network connections to PCs or servers, or to other switches or hubs.

The table below shows the 1000BASE-T MDI and MDI-X port pinouts. These ports require that all four pairs of wires be connected. Note that for 1000BASE-T operation, all four pairs of wires are used for both transmit and receive.

Use 100-ohm Category 5, 5e or 6 unshielded twisted-pair (UTP) or shielded twisted-pair (STP) cable for 1000BASE-T connections. Also be sure that the length of any twisted-pair connection does not exceed 100 meters (328 feet).

Table B-2. 1000BASE-T MDI and MDI-X Port Pinouts		
Pin	MDI Signal Name	MDI-X Signal Name
1	Bi-directional Data One Plus (BI_D1+)	Bi-directional Data Two Plus (BI_D2+)
2	Bi-directional Data One Minus (BI_D1-)	Bi-directional Data Two Minus (BI_D2-)
3	Bi-directional Data Two Plus (BI_D2+)	Bi-directional Data One Plus (BI_D1+)
4	Bi-directional Data Three Plus (BI_D3+)	Bi-directional Data Four Plus (BI_D4+)
5	Bi-directional Data Three Minus (BI_D3-)	Bi-directional Data Four Minus (BI_D4-)
6	Bi-directional Data Two Minus (BI_D2-)	Bi-directional Data One Minus (BI_D1-)
7	Bi-directional Data Four Plus (BI_D4+)	Bi-directional Data Three Plus (BI_D3+)
8	Bi-directional Data Four Minus (BI_D4-)	Bi-directional Data Three Minus (BI_D3-)

**Cable Testing for Existing Category 5 Cable**

Installed Category 5 cabling must pass tests for Attenuation, Near-End Crosstalk (NEXT), and Far-End Crosstalk (FEXT). This cable testing information is specified in the ANSI/TIA/EIA-TSB-67 standard. Additionally, cables must also pass test parameters for Return Loss and Equal-Level Far-End Crosstalk (ELFEXT). These tests are specified in the ANSI/TIA/EIA-TSB-95 Bulletin, "The Additional Transmission Performance Guidelines for 100 Ohm 4-Pair Category 5 Cabling."

Note that when testing your cable installation, be sure to include all patch cables between switches and end devices.

**Adjusting Existing Category 5 Cabling to Run 1000BASE-T**

If your existing Category 5 installation does not meet one of the test parameters for 1000BASE-T, there are basically three measures that can be applied to try and correct the problem:

1. Replace any Category 5 patch cables with high-performance Category 5e or Category 6 cables.
2. Reduce the number of connectors used in the link.
3. Reconnect some of the connectors in the link.



# Appendix C: Specifications

---

## Physical Characteristics

### Ports

16/24 10/100/1000BASE-T, with auto-negotiation

### Network Interface

Ports 1-16/24: RJ-45 connector, auto MDI/X

10BASE-T: RJ-45 (100-ohm, UTP cable; Category 3 or better)

100BASE-TX: RJ-45 (100-ohm, UTP cable; Category 5 or better)

1000BASE-T: RJ-45 (100-ohm, UTP cable; Category 5, 5e, or 6)

### Buffer Architecture

ES4016: 340 KBytes

ES4024: 500 KBytes

### Aggregate Bandwidth

ES4016: 32 Gbps

ES4024: 48 Gbps

### Switching Database

8K MAC address entries

### LEDs

System:

Power (Power Supply)

Port:

Link/Act (Link/Activity)

100M/1000M

### Weight

ES4016: 2.0 kg (4.41 lbs)

ES4024: 2.2 kg (4.85 lbs)

### Size

440 x 172 x 43 mm (17.3 x 6.8 x 1.7 in.)

**Temperature**

Operating: 0 to 40 °C (32 to 104 °F)

Storage: -40 to 70 °C (-40 to 158 °F)

**Humidity**

Operating: 10% to 90% (non-condensing)

**Power Supply**

Internal, auto-ranging transformer: 100 to 240 V, 50-60 Hz, 0.8 A

**Power Consumption**

28 Watts maximum

---

## Switch Features

**Forwarding Mode**

Store-and-forward

**Throughput**

Wire speed

**Flow Control**

Full Duplex: IEEE 802.3x

Half Duplex: Back pressure

**Jumbo Frames**

Support for 9KB jumbo frames

---

## Standards

IEEE 802.3-2005

Ethernet, Fast Ethernet, and Gigabit Ethernet

IEEE 802.3x full-duplex flow control

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## Compliances

CE Mark

### Emissions

FCC Class A

Industry Canada Class A

EN55022 (CISPR 22) Class A

EN 61000-3-2/3

VCCI Class A

### Immunity

EN 61000-4-2/3/4/5/6/8/11

### Safety

UL/CUL (UL 60950-1, CSA 22.2 NO60950-1)

CB (IEC60950-1)



# Appendix D: German Instructions

---

## Eine Site auswählen (Selecting a Site - German)

Die Switch können in ein Standard-19-Zoll-Ausrüstungsgestell oder auf eine flache Ebene montiert werden.

Zum Auswählen eines Standortes beachten Sie bitte die nachstehenden Richtlinien.

- Die Site sollte:
  - Sich in der Mitte aller anzuschließenden Geräte sowie in der Nähe einer Netzsteckdose befinden;
  - Imstande sein, eine Temperatur zwischen 0 und 40 °C (32 und 104 °F) und eine Feuchtigkeit innerhalb von 10% bis 90% (nichtkondensierend) beizubehalten;
  - In einem genügend weiten Abstand (ungefähr 5 cm oder zwei Zoll) von allen Seiten für eine ausreichende Belüftung aufgestellt werden;
  - Für das Installieren, die Kabelverlegung und für Wartungen und Reparaturen leicht zugänglich sein.
  - Die LED-Statusanzeigedioden müssen stets klar und leicht sichtbar sein.
- Sicherstellen, dass das Twisted-Pair-Kabel stets weg von anderen Stromkabeln, Neonleuchteinrichtungen und anderen Quellen von möglichen elektrischen Störungen verlegt wird, wie z. B. von Radios und Transmittern.
- Sicherstellen, dass das Gerät an eine separate Stromquelle mit Erdanschluss mit einer Netzspannung von 100 bis 240 V AC (Wechselstromspannung), 50 bis 60 Hz, und innerhalb in einem Abstand von 2,44 m (8 Fus) zu jedem Gerät installiert wird und on einem separaten Trennschalter bzw. Leistungsschalter mit Strom versorgt wird. Für alle Geräte wird empfohlen, einen Filter oder einen Überspannungsschutz zu verwenden.

## Montage (Rack Mounting Instructions - German)

Switch-Einheiten können an ein standardmäßiges 19-Zoll Einrichtungsrack, einen Arbeitstisch oder ein Regal montiert werden. Folgend finden Sie die Montageanweisungen für jeden Positionstyp.

### Rack-Montage

Beachten Sie die folgenden Faktoren, bevor Sie die Rack-Montage beginnen:

- **Temperatur:** Da die Temperatur innerhalb einer Rackeinheit höher als die Raumumgebungstemperatur sein kann, stellen Sie bitte sicher, dass die Rackumgebungstemperatur innerhalb des angegebenen Betriebstemperaturbereichs liegt. (Temperatur zwischen 0 und 40 °C)
- **Mechanische Last:** Stellen Sie kein Gerät auf eine Rack-Montageeinheit.
- **Stromüberlastung:** Stellen Sie sicher, dass der Netzkreis der Rackeinheit nicht überlastet wird.
- **Erdung:** Die Rack-Montageeinheit muss richtig geerdet werden. Besondere Acht sollten Sie bei Verbindungen geben, die nicht direkt zum Netz führen.

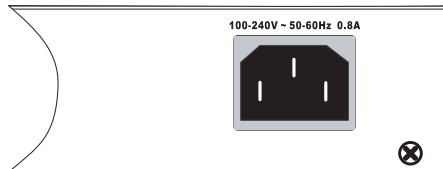
So montieren Sie Geräte an ein Rack:

1. Befestigen Sie die Metallwinkel mit den im Metallwinkel-Montageset erhältlichen Schrauben an dem Gerät.
2. Befestigen Sie das Gerät mit vier Rackmontageschrauben (nicht beigelegt) an dem Rack.
3. Wenn Sie nur einen Switch installieren, dann springen Sie bitte über zu "Verbinden mit einer Stromquelle" auf Seite 3-5 am Ende dieses Kapitels.
4. Wenn Sie mehrere Switches installieren möchten, dann montieren Sie sie untereinander in einer beliebigen Reihenfolge.

## Anschluss an eine Stromquelle (Connecting to a Power Source - German)

So verbinden Sie den Switch mit einer Stromquelle:

1. Stecken Sie den Stecker des Netzkabels direkt in den Stromanschluss an der Rückseite des Switches ein.



**Abbildung 3-5. Stromanschlüsse**

2. Verbinden Sie das andere Ende des Kabels mit einer Schutzkontaktsteckdose („Schuko-Steckdose“, mit Erdungszungen an den Seiten).

**Hinweis:** Im Ausland müssen Sie eventuell ein anderes Netzkabel verwenden. Wählen Sie dazu ein zugelassenes, für die Steckdosen des jeweiligen Landes passendes Netzkabel.

3. Überzeugen Sie sich davon, dass das Gerät mit Strom versorgt wird: Die Betrieb-LED („Power“) an der Vorderseite muss leuchten. Falls nicht, schauen Sie nach, ob das Netzkabel richtig eingesteckt ist.





# Glossary

---

## **10BASE-T**

IEEE 802.3 specification for 10 Mbps Ethernet over two pairs of Category 3, 4, or 5 UTP cable.

## **100BASE-TX**

IEEE 802.3u specification for 100 Mbps Ethernet over two pairs of Category 5 UTP cable.

## **1000BASE-T**

IEEE 802.3ab specification for Gigabit Ethernet over 100-ohm Category 5, 5e or 6 twisted-pair cable (using all four wire pairs).

## **Auto-Negotiation**

Signalling method allowing each node to select its optimum operational mode (e.g., speed and duplex mode) based on the capabilities of the node to which it is connected.

## **Bandwidth**

The difference between the highest and lowest frequencies available for network signals. Also synonymous with wire speed, the actual speed of the data transmission along the cable.

## **Collision**

A condition in which packets transmitted over the cable interfere with each other. Their interference makes both signals unintelligible.

## **Collision Domain**

Single CSMA/CD LAN segment.

## **CSMA/CD**

CSMA/CD (Carrier Sense Multiple Access/Collision Detect) is the communication method employed by Ethernet, Fast Ethernet, or Gigabit Ethernet.

## **End Station**

A workstation, server, or other device that does not forward traffic.

## **Ethernet**

A network communication system developed and standardized by DEC, Intel, and Xerox, using baseband transmission, CSMA/CD access, logical bus topology, and coaxial cable. The successor IEEE 802.3 standard provides for integration into the

OSI model and extends the physical layer and media with repeaters and implementations that operate on fiber, thin coax and twisted-pair cable.

### **Fast Ethernet**

A 100 Mbps network communication system based on Ethernet and the CSMA/CD access method.

### **Gigabit Ethernet**

A 1000 Mbps network communication system based on Ethernet and the CSMA/CD access method.

### **Full Duplex**

Transmission method that allows two network devices to transmit and receive concurrently, effectively doubling the bandwidth of that link.

### **IEEE**

Institute of Electrical and Electronic Engineers.

### **IEEE 802.3**

Defines carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

### **IEEE 802.3ab**

Defines CSMA/CD access method and physical layer specifications for 1000BASE-T Gigabit Ethernet.

### **IEEE 802.3ae**

Defines the access method and physical layer specifications for 10GBASE 10-Gigabit Ethernet.

### **IEEE 802.3u**

Defines CSMA/CD access method and physical layer specifications for 100BASE-TX Fast Ethernet.

### **IEEE 802.3x**

Defines Ethernet frame start/stop requests and timers used for flow control on full-duplex links.

### **IEEE 802.3z**

Defines CSMA/CD access method and physical layer specifications for 1000BASE Gigabit Ethernet.

### **LAN Segment**

Separate LAN or collision domain.

**LED**

Light emitting diode used for monitoring a device or network condition.

**Local Area Network (LAN)**

A group of interconnected computer and support devices.

**Media Access Control (MAC)**

A portion of the networking protocol that governs access to the transmission medium, facilitating the exchange of data between network nodes.

**Modal Bandwidth**

Bandwidth for multimode fiber is referred to as modal bandwidth because it varies with the modal field (or core diameter) of the fiber. Modal bandwidth is specified in units of MHz per km, which indicates the amount of bandwidth supported by the fiber for a one km distance.

**MIB**

An acronym for Management Information Base. It is a set of database objects that contains information about the device.

**Network Diameter**

Wire distance between two end stations in the same collision domain.

**RJ-45 Connector**

A connector for twisted-pair wiring.

**Switched Ports**

Ports that are on separate collision domains or LAN segments.

**TIA**

Telecommunications Industry Association

**Transmission Control Protocol/Internet Protocol (TCP/IP)**

Protocol suite that includes TCP as the primary transport protocol, and IP as the network layer protocol.

**UTP**

Unshielded twisted-pair cable.



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